

EM415 Homework #5 Answers

3.112 a) $T_b = \dot{q}L\sqrt{\frac{D}{4hk}} + T_\infty$

b) $T_o = \frac{\dot{q}L^2}{2k} + T_b$

c) Plot using EES or Mathcad

3.120 for $k = 110 \text{ W/mK}$

$x = 25 \text{ mm} - T = 150.9 \text{ C}$

$x = 50 \text{ mm} - T = 119.9 \text{ C}$

$x = 100 \text{ mm} - T = 96.8 \text{ C}$

3.121a) Case A

$$\epsilon_f = 20.2$$

$$q_f = 151.4 \text{ W/m}$$

$$\eta_f = 0.9611$$

$$R_f = 0.4955 \text{ mK/W}$$

Case B

$$\epsilon_f = 19.3$$

$$q_f = 144.7 \text{ W/m}$$

$$\eta_f = 0.9645$$

$$R_f = 0.5184 \text{ mK/W}$$

3.126 $T_b = \frac{\dot{q}A_g L_g}{\left[h\left(A_g - \frac{\pi D^2}{4} \right) + \sqrt{\frac{hk\pi^2 D^3}{4} \tanh\left(\sqrt{\frac{4h}{kD}} \frac{L}{2} \right)} \right]} + T_\infty$

3.136a) Find the # of fins = 1024

$$q = 276.5 \text{ W}$$

3.145 a) $\eta_f \approx 0.95$

$$q_f = 48.9 \text{ W}$$

b) $q' = 6684 \text{ W/m}$